

Course guide

320025 - EQSE - Efficiency and Quality in Electrical Systems

Last modified: 02/04/2024

Unit in charge: Terrassa School of Industrial, Aerospace and Audiovisual Engineering
Teaching unit: 709 - DEE - Department of Electrical Engineering.

Degree: BACHELOR'S DEGREE IN ELECTRICAL ENGINEERING (Syllabus 2009). (Compulsory subject).

Academic year: 2024 **ECTS Credits:** 6.0 **Languages:** Catalan, Spanish

LECTURER

Coordinating lecturer: Emiliano Aldabas

Others:

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Transversal:

1. TEAMWORK - Level 2. Contributing to the consolidation of a team by planning targets and working efficiently to favor communication, task assignment and cohesion.
2. EFFECTIVE USE OF INFORMATION RESOURCES - Level 3. Planning and using the information necessary for an academic assignment (a final thesis, for example) based on a critical appraisal of the information resources used.
3. EFFICIENT ORAL AND WRITTEN COMMUNICATION - Level 3. Communicating clearly and efficiently in oral and written presentations. Adapting to audiences and communication aims by using suitable strategies and means.

TEACHING METHODOLOGY

All available documentation to begin the course in Digital Campus: Timed detailed programming and activities to develop, readings and class presentations, articles and technical documentation, web's interest to conduct practices, etc.

LEARNING OBJECTIVES OF THE SUBJECT

Recognize and quantify the importance of rational and efficient use of energy, focusing on electric power applications, both from the standpoint of economic and legal environment.

Assess and quantify the quality of electric power, as long as it is a 'product' we buy and use.

Providing knowledge and information that will enable studies on quantitative and qualitative aspects above.

Know the organizations, businesses, institutions, etc., Which are related to the topic.

STUDY LOAD

Type	Hours	Percentage
Hours large group	30,0	20.00
Hours medium group	15,0	10.00
Hours small group	15,0	10.00
Self study	90,0	60.00

Total learning time: 150 h

CONTENTS

TOPIC 1: EFFICIENT USE OF ELECTRICAL ENERGY

Description:

- 1.1. Introduction
- 1.2. Inefficiencies in electrical systems.
 - 1.2.1. Power in electrical systems.
 - 1.2.2. Performance, power factor and efficiency factor.
 - 1.2.3. Load inefficiencies.
 - 1.2.4. Installation inefficiencies.
 - 1.2.5. Supply inefficiencies.
- 1.3. Legal references and regulations.
- 1.4. Improving the efficiency of electrical systems.
- 1.5. Applying reactive power compensation in non-distorted networks.
- 1.6. Electricity rates and demand management.

Laboratory sessions

Practical P1. Efficiency analysis of loads and installations.

Practical P2. Efficiency analysis of generation and transport systems.

Full-or-part-time: 24h

Theory classes: 12h

Practical classes: 8h

Laboratory classes: 4h

TOPIC 2: ELECTROMAGNETIC COMPATIBILITY, QUALITY AND EFFICIENCY

Description:

- 2.1. Introduction to the problem of interference. Definitions. Symbols used. Relationship between levels of emission and immunity. EMI generation of propagation.
- 2.2. Disturbances.
 - 2.2.1. Harmonics: classification and types. Transients and switching. Electrostatic discharges. Disturbances in low-voltage electrical networks.
 - 2.2.2. Disturbance sources.
 - 2.2.3. Coupling.
- 2.3. Shielding
- 2.4. Earth and ground.
- 2.5. Cables
- 2.6. Solutions to electromagnetic compatibility problems.
- 2.7. Electromagnetic compatibility regulations.

Laboratory sessions

Practical P3. Design of an installation according to electromagnetic compatibility criteria.

Full-or-part-time: 16h

Theory classes: 10h

Practical classes: 4h

Laboratory classes: 2h

TOPIC 3: QUALITY OF ELECTRICAL ENERGY

Description:

- 3.1. Introduction
 - 3.2. Disturbances in electrical networks: types, definitions and effects.
 - 3.2.1. Frequency variations.
 - 3.2.2. Voltage fluctuations.
 - 3.2.3. Imbalances in three-phase systems.
 - 3.2.4. Harmonics.
 - 3.2.5. Oscillatory transients.
 - 3.2.6. Impulsive transients caused by lightning.
 - 3.2.7. Flicker.
 - 3.3. Legal references and regulations.
 - 3.4. Quality of service
 - 3.4.1. Continuity of supply. Indicators (ASIDI, ASIFI).
 - 3.4.2. Product quality.
 - 3.4.3. Customer information.
 - 3.5. Measuring and recording electrical quantities.
 - 3.6. Disturbance compensation and filtering.
 - 3.7. Electrical installations and ground connection.
 - 3.8. Emergency systems.
- Laboratory sessions
- Practical P4. Measurement of quality indicators (I).
 - Practical P5. Measurement of quality indicators (II).
 - Practical P6. Implementation of corrective systems.

Full-or-part-time: 26h

Theory classes: 14h

Practical classes: 6h

Laboratory classes: 6h

GRADING SYSTEM

There will be a continuous assessment model for the basic purpose of weighing both self-employment as teamwork of students.

First test: 35%

Second test: 35%

Other reports and papers presented: 10%

Laboratory: 10%

Effective oral and written communication: 10%

Unsatisfactory results from the examination of the first test may be redirected by a written test to be carried out on the day set for the examination of the second test. Students with a score lower than 5.0 will be able to access this test. The qualification mark will be between 0 and 5 points. The score obtained by the renewal will replace the initial result as long as it is higher than the one before.

For those students who meet the requirements and submit to the reevaluation examination, the grade of the reevaluation exam will replace the grades of all the on-site written evaluation acts (tests, midterm and final exams) and the grades obtained during the course for lab practices, works, projects and presentations will be kept.

If the final grade after reevaluation is lower than 5.0, it will replace the initial one only if it is higher. If the final grade after reevaluation is greater or equal to 5.0, the final grade of the subject will be pass 5.0.

EXAMINATION RULES.

The evaluations consist of the evaluation followed by acts of face and / or other measurable activities that are part of continuous assessment. Failure to perform any acts or activities, shall be deemed qualified to zero.



BIBLIOGRAPHY

Basic:

- Balcells Sendra, Josep [et al.]. Eficiencia en el uso de la energía eléctrica. Barcelona: Marcombo/Circutor, 2011. ISBN 9788426716958.
- León Martínez, Vicente [et al.]. Ineficiencias de los sistemas eléctricos : efectos, cuantificación y dispositivos de mejora de la eficiencia. Valencia: Universidad Politécnica de Valencia, 2001. ISBN 8497051211.
- López Melendo, Jacinto. Calidad de potencia: armónicos y factor de potencia [on line]. Barcelona: Marcombo, 2018 [Consultation: 30/09/2024]. Available on : https://www-ingebook-com.recursos.biblioteca.upc.edu/ib/NPcd/IB_BooksVis?cod_primaria=1000187&codigo_libro=11376. ISBN 9788426725714.

Complementary:

- Arrillaga, J.; Watson, N.R. Power system harmonics. 2nd ed. West Sussex, England: John Wiley & Sons, 2003. ISBN 0470851295.
- Balcells Sendra, Josep. Calidad y uso racional de la energía eléctrica. 2a ed. Barcelona: Circutor, 2001. ISBN 8469926667.
- Dugan, Roger C. [et al.]. Electrical power systems quality. New York: McGraw Hill, 2003. ISBN 007138622X.
- Enríquez Harper, Gilberto. El ABC de la calidad de la energía eléctrica. México: Limusa Noriega, 2001. ISBN 9681857798.